MISSOURI DEPARTMENT OF NATURAL RESOURCES

Atrazine

Fact Sheet
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Division of Environmental Quality
Public Drinking Water Program

What is atrazine?

Atrazine, like cyanazine and simazine, is a member of the triazine class of herbicides. It is one of the most widely used agricultural pesticides in the United States, with approximately 65 to 80 million pounds used each year. A 1992 study estimated that 3.8 million pounds of atrazine were applied in that year to Missouri crops, primarily corn and sorghum. Atrazine is used to control many annual broad-leaf weeds and certain grasses in corn, sorghum, sugarcane, macadamia and subtropical tree fruits such as guavas. It is also used for weed control on conifer restoration, Christmas tree plantations and fallow land.

Is atrazine regulated in drinking water?

The Missouri Department of Natural Resources sets enforceable standards called Maximum Contaminant Levels (MCLs) and monitoring requirements for specific contaminants under the Missouri Safe Drinking Water Act. In 1993, the MCL for atrazine in public water systems was established at 0.003 milligrams per liter (mg/l) or parts per million. From 1993 through 1995, public water systems are required to collect and analyze samples for four quarters of one year, unless the department issues a waiver. Subsequent monitoring may be required at an increased or decreased frequency depending on whether atrazine is detected in the initial round of sampling.

A public water system is in violation of the atrazine standard if the running annual average of quarterly samples at any sampling point exceeds the MCL. Systems in violation must issue a public notice to inform all customers of the violation and must submit to the department a compliance schedule that outlines how and when the system plans to return to compliance. The compliance schedule must include deadlines for corrective actions, including the installation of treatment, typically granular or powdered activated carbon, or other actions to reduce levels below the MCL, such as controlling the use of atrazine in the watershed of a surface water source. Failure to develop a compliance schedule or to meet the deadlines will result in appropriate enforcement action by the department.

Is my water safe to drink?

Your water is safe to drink if the annual average concentration of atrazine is below the Maximum Contaminant Level (MCL) of 0.003 mg/l. The MCL for atrazine is based on the health risk posed by long-term exposure and also includes a margin of safety. Therefore, occasional or short-term exposure to levels slightly exceeding the MCL are not believed to pose a serious health risk. However, chronic exposure to levels exceeding the MCL could pose a lifetime risk, and the public water systems would be required to take steps to reduce levels below the MCL.

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What are the potential adverse health effects of atrazine?

Studies have shown heart disease and possibly cancer to be potential adverse health effects of atrazine. When dogs were fed high doses of atrazine, over 300,000 times the MCL for drinking water, severe heart disease was found. At doses 50,000 times the MCL, findings showed a trend toward the development of cardiac pathology. The U.S. Environmental Protection Agency (EPA) classifies atrazine as a possible human carcinogen due to limited evidence that the chemical may cause cancer. One study in rats showed a significant dose-related increase in mammary tumors in females. Other studies in rats and mice did not show cancer-causing effects.

Does the atrazine standard protect all segments of the population, including children?

In doing its risk assessment for atrazine, EPA considered cancer and non-cancer effects. For non-cancer effects, EPA identified the level at which no effects occurred in test animals and applied an uncertainty factor of 100. To account for carcinogenic potential of atrazine, EPA applied an additional factor of 10. The atrazine standard is equivalent to a risk of two excess cancer cases in 100,000 persons based on a lifetime exposure. The large margins of safety help to protect against the uncertainties associated with unknown effects in sensitive sub-populations like children and multiple exposures from other pesticides and from degradation products.

What is the fate of atrazine in the environment?

Atrazine is considered somewhat persistent in water and mobile in soil; it does not break down quickly, dissolves readily in water and has a low tendency to adhere to soil particles. It is one of the most frequently detected pesticides. Its highest concentrations are found in surface water in the Midwest corn belt. In streams and rivers, concentrations tend to peak in May to July following pesticide application. Atrazine may remain elevated at several parts per billion year-round in some bodies of water, based on limited data from lakes and reservoirs.

Public water systems that use surface water are particularly vulnerable to atrazine contamination. The department analyzed drinking water samples from 100 surface water systems in March, June, September, and December of 1994 and detected atrazine in 44 of those systems. Ten systems exceeded the MCL for atrazine.

The department also analyzed 1933 samples from public water systems that use wells. Only one of the samples had a detectable level of atrazine. Private wells were not tested, but are more likely to be at risk due to shallow or poor construction.

How do pesticides enter surface waters?

Pesticides such as atrazine can enter surface waters directly in runoff or indirectly through atmospheric deposition or groundwater.

- Pesticides are carried in runoff in two forms: attached to sediments or dissolved in runoff water. The most important factors affecting runoff losses appear to be topography and soils, how the land is managed, rainfall patterns, pesticide application rates and the time interval between application and subsequent runoff events. Research has shown that the majority of atrazine enters surface waters during the first month after application.
- Pesticides can also enter surface waters through drift losses caused by wind effects during application. Drift losses depend almost entirely on the application method used, ranging from negligible for proper ground applications to nearly half for some aerial applications. Volatilization is another way pesticides can indirectly enter surface waters. The extent of volatilization appears to increase with increased temperature and decrease when applied pesticide is incorporated into the

soil.
- Pesticides can also enter groundwater, with rates dependent upon several factors, including application rate, soil composition, soil moisture, plant uptake and management practices. Once in groundwater, atrazine can directly enter surface waters in the form of base flows of rivers and streams or as seepage into lakes, ponds and wetlands.

What management practices can minimize the amount of pesticides reaching surface waters?

Several techniques can minimize the amount of pesticides reaching surface waters:

- Follow label instructions and store and dispose of pesticide containers appropriately.
- Apply pesticides at a safe distance from all surface waters.
- Time applications to maximize the time between application and the next runoff event.
- Time applications to avoid wind speeds greater than five miles per hour to reduce drift losses.
- Time applications to take advantage of humid and cool days to reduce volatilization losses.
- The formulation of pesticides can have a considerable effect on the potential for runoff. The appropriate formulation is often dictated by the mode of action and the properties of the pesticides, but, where a choice exists, granules, pellets and emulsions generally reduce volatility and drift losses when compared to wettable powders, micro-granules, dusts, fine liquid sprays,
- aqueous solutions and liquid concentrates.
- Ground application of pesticides with incorporation into the soil can significantly reduce drift losses and runoff losses. Where aerial application is necessary, appropriate measures to increase application efficiency include assuring an even distribution of pesticide to the target and releasing pesticides as near to the land surface as possible.
- Conservation tillage, contour farming and strip-cropping practices can reduce losses of both dissolved and sediment-bound pesticides. Properly designed and maintained grassed waterways and filter strips may reduce the runoff of sediment-bound pesticides.
- Integrated best management techniques can reduce the rate of pesticide application and pesticide losses to the environment.

Has EPA taken steps to reduce the risks posed by atrazine?

Yes. In 1990, EPA approved amendments to the atrazine label that made it a restricted use pesticide, which means it can only be used by or under the supervision of a certified applicator. EPA also required reduced application rates, protective clothing for agricultural workers and set-backs from wells, meaning that atrazine may not be applied immediately surrounding wells, to protect groundwater. In 1992, EPA approved additional rate reductions, set-backs to protect surface water and deletion of some non-crop uses. The registrant of atrazine also initiated water monitoring and research activities to evaluate the effectiveness of these measures and is conducting educational outreach to growers to reduce water contamination. Research is ongoing to determine whether these measures have been effective in reducing contamination of ground and surface water.

Is EPA considering regulatory actions against atrazine?

EPA has initiated a special review for the triazines, which include atrazine. EPA currently considers cancer to be the potential adverse health effect of greatest concern for the triazines, given the known toxicity and exposure patterns for these pesticides. EPA is working to resolve several uncertainties related to the carcinogenicity of the triazines, the toxicity of triazine break-down products and the impact of recent risk reduction measures.

Special review is EPA's procedure for determining whether the use of a pesticide poses unreasonable risks to people or the environment. In making this determination, EPA must consider

the pesticide's risk and benefits. A special review can result in a decision to cancel, restrict or continue the pesticide's uses in question. EPA conducts special reviews following a structured process that allows for public involvement.

EPA has published a notice of special review in the federal register, formally announcing initiation of the special review and explaining the rationale for the decision. EPA's next course of action will likely be to conduct a comprehensive risk and benefit analysis of each use of the triazines. Ultimately, EPA will issue a final decision by publishing a notice of final determination or may negotiate a settlement with the registrants.

How important is atrazine? Are alternatives available?

Atrazine is among the most widely used pesticides in the United States. Other herbicides are available as alternatives, but they may not be as effective. It is not known at this time what a massive shift to alternatives would cost or what the environmental impacts would be. The impacts of a shift to alternatives is one of the issues typically analyzed in a special review.

For more information, call the Department of Natural Resources' Public Drinking Water Program at (573) 751-5331 or 1-800-361-4827.